Spinning Dials

How to dominate the Ventilator

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Two Strategies of Ventilation

Injury This strategy is for patients with lung injury and those prone to lung injury. Essentially this means every intubated patient except those with…
Obstruction Use this strategy when patients are in the midst of an Asthma/COPD exacerbation

Injury Strategy

Based on ARDSnet (ARMA Study-N Engl J Med 2000;342,1301-1308)

Mode

Assist Control (AC)-Volume

Tidal Volume (Vt)=Protection

6-8 cc/kg, based on PBW (see last page). If ALI/ARDS, the goal is to get down to 6 cc/kg.
Why? Injured lungs are baby lungs
This setting *should not* be altered to fix ventilation
It only gets changed for lung protection (i.e. to prevent barotrauma/volutrauma)

Flow Rate (IFR)=Comfort

60-80 lpm
This setting controls how quickly the air goes in

Rate (RR)=Ventilation

Initially 18, adjust based on CO_2 and ventilatory needs
Va for a normal CO2 when not intubated is 60 cc/kg/min
We need to double that to 120 cc/kg/min when intubated b/c of increased deadspace
Need double that volume (240 cc/kg/min) to send CO2 from 40 to 30
Try to keep mildly hypercarbic

FiO_2/PEEP=Oxygenation

Many ventilator evils would be fixed if these were on one knob

1. Start at 100% and PEEP of 0 or 5
2. Wait 5 minutes and then draw an ABG
3. Then set the FiO2 to 30% and start titrating based on the chart. Go up every 5-10 minutes; quicker if low sats

OXYGENATION GOAL: PaO_2 55-80 mmHg or SpO_2 88-95%
Use a minimum PEEP of 5 cm H_2O. Consider use of incremental FiO_2/PEEP combinations such as shown below (not required) to achieve goal.

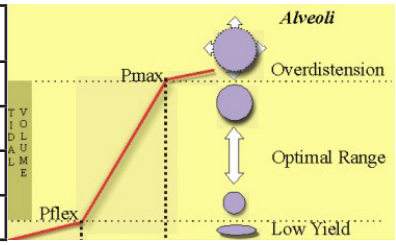
Lower PEEP/higher FiO2

FiO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO_2	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

Many doctors, even in specialties that should know better, are irrationally afraid of PEEP.

Good	Bad	Ugly Myths
Improves V/Q Match	Decreased Venous Return	Causes Pneumothorax
Decreases Shunt	May need more fluid	Pt's head will explode
Decreases Atelectasis/trauma		
Improves Spont. Breathing		



Check Plateau Pressure

Check it after initial settings and at regular intervals thereafter
Use the inspiratory hold button, hold for 0.5 sec—look at pressure gauge
The peak pressure is essentially meaningless
Plateau pressure must be maintained <30 cm H20. Keep lowering the Vt until Plat <30. You may need to go as low as 4 cc/kg.

Disadvantages of this strategy

It is not the most comfortable strategy of ventilation for awake, spontaneously breathing patients
Use sedation/pain medications
Give enough flow; if you see the patient sucking the straw, increase the IFR setting

Obstructive Strategy

Goal is to give as much expiratory time as possible

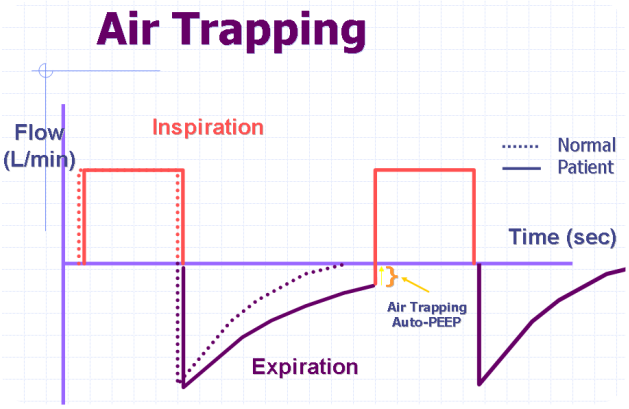
Mode-Assist Control
Vt-8 cc/kg by PBW
IFR-80-100 lpm
PEEP-0
FiO2-use whatever you need, most folks are fine at 40%
RR-Start at 10 bpm. Look for I:E of 1:4 or 1:5 Adjust the rate to achieve this.

Permissive Hypercapnia

Patients will need tons of sedation/opioids
Keep pH above 7.1; rarely, you may need a bicarb drip to accomplish this

AutoPEEP and Airtrapping

They decrease venous return, impede expiration, & impede spont vent



Other Concerns

Large Tubes

At least 8.0 whenever possible, for both male and female patients. Pulmonary toilet and ICU care is miserable with small tubes. Biofilm forms within the first two days reducing tube size dramatically.

Ventilator Alarms

Treat them like a code announcement. The closest person should *run* to the patients bedside and assess the situation.

Appendix

NIH NHLBI ARDS Clinical Network
Mechanical Ventilation Protocol Summary

INCLUSION CRITERIA: Acute onset of

1. $PaO_2/FiO_2 \leq 300$ (corrected for altitude)
2. Bilateral (patchy, diffuse, or homogeneous) infiltrates consistent with pulmonary edema
3. No clinical evidence of left atrial hypertension

PART I: VENTILATOR SETUP AND ADJUSTMENT

1. Calculate predicted body weight (PBW)
   Males = 50 + 2.3 [height (inches) - 60]
   Females = 45.5 + 2.3 [height (inches) -60]
2. Select any ventilator mode
3. Set ventilator settings to achieve initial V_T = 8 ml/kg PBW
4. Reduce V_T by 1 ml/kg at intervals ≤ 2 hours until V_T = 6ml/kg PBW.
5. Set initial rate to approximate baseline minute ventilation (not > 35 bpm).
6. Adjust V_T and RR to achieve pH and plateau pressure goals below.

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FiO_2	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

Higher PEEP/lower FiO2

FiO_2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
PEEP	5	8	10	12	14	14	16	16

FiO_2	0.5	0.5-0.8	0.8	0.9	1.0	1.0
PEEP	18	20	22	22	22	24

PLATEAU PRESSURE GOAL: ≤ 30 cm H_2O
Check Pplat (0.5 second inspiratory pause), at least q 4h and after each change in PEEP or V_T.
If Pplat > 30 cm H_2O: decrease V_T by 1ml/kg steps (minimum = 4 ml/kg).
If Pplat < 25 cm H_2O and V_T< 6 ml/kg, increase V_T by 1 ml/kg until Pplat > 25 cm H_2O or V_T = 6 ml/kg.
If Pplat < 30 and breath stacking or dys-synchrony occurs: may increase V_T in 1ml/kg increments to 7 or 8 ml/kg if Pplat remains ≤ 30 cm H_2O.

How to perform an Insp Hold to Check Plateau Pressure

1. Press the "Insp Hold" button and hold it
2. Read the value here

Questions

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